Platformization of a Cloud Service

Mikael Gustavsson
Applied Infrormation Technology, mikael.gustavsson@ait.gu.se

Jan Ljungberg
Göteborg University, jan.ljungberg@ait.gu.se

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Mikael Gustavsson
University of Gothenburg
Gothenburg, Sweden
mikael.gustavsson@ait.gu.se

Jan Ljungberg
University of Gothenburg
Gothenburg, Sweden
jan.ljungberg@ait.gu.se

Abstract

The digital platform has in a few years emerged as a key concept to depict a new kind of business model, organizational form and technical architecture. The transformational power of platforms is manifested by the notion of "platformization", referring to the drive towards the platform as a dominant infrastructural and economic model. In this paper, we analyze the nature of platformization processes and platform dynamics. We do this by applying a historical case study approach to the evolution of one digital platform, Microsoft Azure. By presenting three narratives we show how Microsoft Azure, has evolved from being mainly an efficient cloud computing and storage service to become a cloud platform, enabling digital capabilities and innovation at an unprecedented scale. We then discuss how this transformation towards a platform, was shaped by both the evolving digital materiality of the artefacts especially in terms of convergence and generativity, and the discursive work conducted by Microsoft through their official Microsoft Azure blog. We contribute with increased knowledge of innovative cloud platforms more specifically, and platform dynamics and platformization processes more generally.

Keywords: Platformization, Platforms, Cloud Computing, Generativity

Introduction

The digital platform has in a few years emerged as a key concept to depict a new kind of business model, organizational form and technical architecture (Gawer 2014; Moazed and Johnson, 2016; Parker et al. 2016). The transformational power of the phenomena is manifested by the notion of "platformization", referring to the drive towards the platform as a dominant infrastructural and economic model (Helmond 2015; Nieborg and Poell, 2018). Digital platforms have novel properties which can largely be deduced from processes that mediate their creation (Ekbia 2009). Consequently, a close examination of such processes leads to a good understanding of how these digital artifacts appear both as representations of specific material arrangements (Dourish 2017), as well as solidified object in discourse (Gillespie 2010). In this paper, we articulate the platformization process by following the case of a cloud service over time, and its transition from a plain, but efficient storage service and hosting provider for web applications, to a powerful platform for innovation. Such a transition consists of changes in the technology, but also of discursive work and meaning making when the technology is brought into use (Bazerman 1998; 1999). Thus, we consider digital artefacts as both cultural and material creations (Doursih 2017; Lee 2017; Schulte 2013; Buckland 1991). They are cultural in the sense that they are socially constructed technologies invented and implemented by developers and entrepreneurs who acts in already existing discursive systems. Systems that shapes actors, the tools they use, the way they perceive the world, and the technological artefacts created by them (Kallinikos 2002). At the same time digital artefacts exhibit attributes - materialities - that

enable, constrain or limit use (Dourish 2017; Kallinikos et al. 2013). These attributes determine how a digital technology can be approached, but in contrast to other types of technologies (where use is often limited to a specific task), digital technologies is incomplete to their nature and open for unanticipated use at a much grander scale (Kallinikos 2002; 2013).

In this paper, we inquire into the technical features and the discursive work that constitutes the evolution of a digital platform. More specifically we investigate how Microsoft, through their cloud computing service *Microsoft Azure*, has evolved from being a product-centric to a cloud-centric company. Inspired by Ciborra et al. (2000) research approach, our intention is to follow in the traces of a platform's development, dig into the archives of its history, interpret what we see and by using theories that we have found useful, tell the story of a cloud (Pentland 1999). By analysing the interplay between digital technology, and how people have tried to communicate and make sense of it, we uncover how a culture of digital technology arises and gets shaped over time (Dourish 2017; Lee 2017; Bazerman 1999). Thereby, we adhere the call from de Reuver et al. (2017) on researching the dynamics of platforms, and how they evolve, by performing a longitudinal case study. Especially, we discuss how digitality - through generativity and convergence - affects those dynamics. We accomplish this through analysing the official company cloud-platform blog from the start in 2007 up until now. Given these prerequisites, we pose the question: *How can we understand the process of platformization in the context of a cloud computing service?*

The paper proceeds as follows: The next section position the paper within related research in the intersection of clouds and platforms in general, specifically turning to the notion of 'cloud computing platform'. We then present the reader to a theoretical framework of platformization. The subsequent section presents the research design, followed by the outlining of the result. We then provide a section of discussion. The last section concludes the paper.

Theoretical Background

Cloud computing

To cope with the inherent complexity of digital technology, the notion of layered design – where each layer abstracts the complexity of the foregoing – divides the digital stack into several independent domains. One of the latest additions to this stack of digital abstractions is "Cloud Computing" (Lee 2017). The primary use for cloud computing has traditionally been as an outsourcing alternative, where an organization can transfer their IT-infrastructure from their own datacentre to the 'Cloud', and thereby increase cost-effectiveness and rationalization (Marston et al. 2011). Over time, some of these cloud services has evolved into digital behemoths (Lee 2018), acting as enablers of innovation, digital capabilities and computing power at an unprecedented scale. The ability to continuously innovate and create value in new, novel ways, create opportunities for both the customers and the cloud platforms. At the heart of this evolution, is the transformation of Cloud Services into Cloud Computing Platforms.

As a metaphor, the notion of the *cloud* gives a constantly shifting and evolving construct a simpler and more abstract form. An abstraction that hides the complex systems of computer resources of which it actually consists – the data centers, hard drives, routers, fiber-optic cables, networks and people (Hu 2016; Venters and Whitley 2012). The dream of computation as a public utility has long been nourished by computer scientist; the idea of interconnected and distributed resources which appear as a common supplier of services (Mosco 2014; Armbrust et al. 2010). In this notion of a central pool of computing power the 'cloud' appears as a construct which purpose is to circumvent the underlying complexity of reality. I.e., where "a physical network [is] turned into a cloud-shaped icon, or a warehouse full of data storage servers [is] turned into a 'cloud drive'" (Hu 2016, p. x). Accordingly, in public discourse the cloud arises as a single computer resource – a structural metaphor, that depends on a semantic richness which gives the term its discursive resonance (Gillespie 2010).

Platforms

The notion of *platform* has emerged as a concrete, yet ambivalent imaginary. Concrete in the sense that the various contours of the phenomenon are vastly described in existing literature, but ambivalent in the sense that the different streams of literature doesn't always convey to the same view on what constitute a platform. The metaphor of platform is "specific enough to mean something, and vague enough to work across multiple

venues for multiple audiences" (Gillespie 2010, p. 349). Of lately, the notion of *platformization* has occurred to describe the power of the platform model's expansion into new areas, and in becoming a dominant infrastructural and economic model (Hellmond 2015; Nieborg and Poell 2018; Plantin et al. 2018).

A lot of attempts have been made in order to delineate and categorize platforms in different ways (cf. Evans and Gawer 2016; Gawer 2014; Moazed and Johnson 2016; Srnicek 2017). For the purpose of this paper we will delineate two broad categories of platforms in terms of business models and technical architecture. From a business perspective, the value of a platform could either be to *reduce transaction costs* or to *enable innovation* (Evans and Gawer 2016).

T*ransaction platforms* act as intermediaries, facilitating transactions between parties. Srnicek (2016) views the platform as a new type of firm which are characterized by their possibility to develop and deliver the infrastructure needed to intermediate between user groups, and coordinate peer-to-peer transactions of knowledge, goods, labor or other resources. A key point is that this intermediation can be done by the transaction platform without owning or controlling the resources that are mediated. Acting as intermediaries, platforms extract data in an unprecedented scale and thereby becomes an "extractive apparatus for data" (Moazed and Johnson 2016; Srnicek 2017, p. 47). Online labor platforms such as Uber is an example of such a platform firm. From the perspective of transaction platforms, platformization can be considered as a process driven by lowered transaction costs and network effects, making the platform a dominant business model, and boosting the growth of specific global platforms in a winner takes all logic (Kenney and Zysman 2016; Moazed and Johnson 2016; Srnicek 2017).

The *Innovative platform* consists of building blocks which are used by third party developers to innovate and to develop complementary services, and specific products and services. From the perspective of innovative platforms, the process of platformization is about opening up architectural and governance control points, through a diverse set of boundary resources making the codebase of the platform extensible (Constantinides 2018; de Reuver et al. 2017). By doing that, generative capacity is added (Zittrain 2005) that open for further innovation to happen both through data-driven improvements (Lee 2018), and the addition of new functionality.

The notion of *cloud computing platform* – as used in this paper – refers both to a technical artefact, as well as a business model. While 'cloud computing' is a technological paradigm that can be described as a way of extending computing resources through virtualization (a technology that can be provisioned either through an organization's own servers or from the outside) the notion of a 'cloud computing platform' points to a firm – the platform owner or cloud provider – who runs a business dedicated to rent out cloud computing resources. Cloud computing can be described as a utility, a model for users to convenient access shared configured, on-demand computing resources (Zhang et al. 2010). The business model utilized by cloud computing platforms employs a service-driven, subscription-like approach - 'as a Service'. Often, these services are grouped in three categories: *IaaS* - Infrastructure as a Service - on-demand provisioning infrastructure capabilities through virtualization (VMs); *PaaS* - Platform as a Service - Abstracting infrastructural undertakings, presenting a framework to use for developers; *SaaS* - Software as a Service - the cloud provider offers their own cloud applications (Mell and Grance 2011; Mosco 2014; Zhang et al. 2010).

In this paper we analyze how a rudimentary, small-scale, web-hosting service over time evolves into a complex, innovative, and world-spanning cloud platform. In order to accomplish this, we turn, on the one hand, to the material aspects by recognizing that there exist attributes, characteristics, to digital technology that enable some things and preclude others (Kallinikos et al. 2010). But we do also acknowledge the power of discourse in mediating the platform, and here we draw extensively on Bazerman (1999; 1998) and his notion of 'Heterogeneous Symbolic Engineering' as well as his thoughts on 'a rhetoric of technology': "Technology constantly invites social, legal, personal, and economic discussions that shape how that technology becomes incorporated into new ways of life." (Bazerman 1998, p. 386).

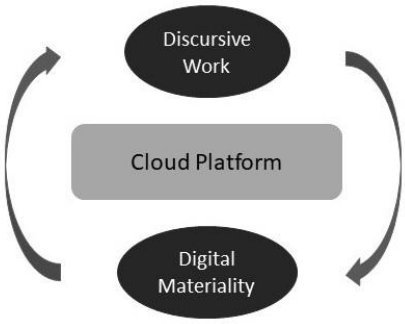

Figure 1. Theoretical Framework

Given Bazermans view on technology as mute – that it needs to be communicated to get foothold in different discursive systems – we suggest that the platformization process is shaped both by *digital materiality* and *discursive work* (figure 1).

Digital Materiality

There is a longstanding discussion on the of relation between discourse and materiality, their nature and ontological status (Putnam 2014). To be able to account for how digital materiality develops and unfolds in our analysis, we employ Bazerman's (1999) concept of 'material accountability' as a bridge between what is communicated in the blog and what can be considered 'real'. In his theory of 'Symbolic Invention' – and the subsequent analysis of how Thomas Edison and colleagues tried to anchor the concept of 'incandescent lightning' in the various discursive systems of the time – Bazerman introduced the notion of 'material accountability' as follows: "The success of representations occurs in particular circumstances and, often, in systems held directly accountable to manifestations of the material technology [...] [T]he technology must be physically realized if it is to maintain discursive value [...]" (Bazerman 1999, p. 340). Accordingly, materiality is not reached first-hand, but through the testament of communication. But as Bazerman points out, any chimera loses rapidly in strength if it is not filled with substance. Given Microsoft's Azure's popularity, extensive growth and large market share, we therefore consider the discourse having high 'material accountability'.

In their meditation over the ambivalent ontology of digital artefacts, Kallinikos et al. (2013) points to the incompleteness of digital technology, that it is "perpetually in the making" (p.357). "They are objects yet they lack the plentitude and stability afforded traditional items and devices" (Kallinikos et al., 2013, p. 357). This notion of technology in constant flux complicate things when trying to give a correct testament to the attributes of a digital artefact which is shaped and changed over time. In order to grasp the materialities of the cloud computing platform, we see the need of identifying the revelation in relation to its parts. As Dourish (2017, p. 59) points out, digital materiality "are properties of code, to be sure, but also of data, of systems, of protocols, of configurations, of standards and of structures" Most importantly they are properties not of abstract things, but of instances and implementations". Given the rapid development of these types of platforms – they consist of countless artefacts, of which each one could be dissected in search for specific materialities – and that our interest of research is the cloud computing platform as an entity, we need a good-enough way to reason about materiality on a high-enough abstract level. One where we do not get lost in detail but are able to describe a situation which could be considered both relevant and interesting. By adopting a processual perspective, we aim to uncover the operations, activities and attributes involved in the qualification of digital artefacts (Ekbia 2009). We recognize the infrastructural aspect of platformization (Helmond 2015; de Reuver et al. 2017; Nieborg and Poell 2018), but to that add a generative aspect. By that, we align to a bifocal perspective on platforms and infrastructures (Plantin et al. 2018). Accordingly, the material aspect of the platformization process put forward in this article, consists of a converging aspect – how the platforms diffuses to act as infrastructure (Kallinikos et al. 2013; Tilson et al. 2010); as well as a generative aspect – how the platform present capabilities for innovating further (Kallinikos et al. 2013; Yoo et al. 2012; Zittrain 2005).

Discursive Work

The concept of discourse, points to the ways that language shape social relations and the social world (Livholts and Tamboukou 2015). We adhere to Laclau and Mouffes (2014) discourse theory, which assumes that all objects and practices are meaningful (and therefore exists within discourse). This perspective pays interest to how and in which ways social practices constructs and forms the discourses which constitute social reality, and thus in turn shapes social practices. Adding to this perspective, we have been inspired by Bazerman (1999; 1998), and his notion of 'Heterogeneous Symbolic Engineering' and 'a rhetoric of technology'. Bazerman (1999; 1998), in line with Laclau and Mouffes (2014) reasoning, recognizes that there exists a tangible world, but the *meanings* that objects possess is obtained via discursive work, when articulated into discourse. "As a technology on its way to successful integration finds its satisfactory representation within each [discursive] system, it takes on system-appropriate meanings [...]: a legal entity, a financial entity, an end product of a production process, a series of costs, a social desirable, and so on." (Bazerman 1999 p. 339).

We build our analytical foundation, regarding discursive work, using some of Bazermans (1999) theoretical notions, namely: 'symbolic engineering', 'discursive systems', 'material accountability', and 'discursive restingpoints'. Bazerman (1999) acknowledge technologies as potent artefacts, yet they are built in social worlds. These social worlds are worlds of symbolic transactions and meaning attributed discourses. Therefore, the notion of *symbolic engineering* emphasizes the importance of "the development of symbols that will give presence, meaning, and value to a technological object or process [...]" (p. 335). A fact that makes technology a bit special when it comes to how it is conveyed in discourse, according to Bazerman (1998), is that it strikes widely; that "[t]he words of technology [...] seem to flow all over the discursive landscape, arguing for value in the terms of business, law, government, the pubic, and consumers" (p. 384). This means that technology is not understood in one, public discourse, but arises as a phenomenon in many specific *discursive systems*: "Both law and journalism require that the world be translated into their terms to be regulated or to become news, but technology is translated into the terms of the world so as to gain the support and use it requires for its existence" (p. 384). To be able to account for the discursive-material problem and show that one cannot just talk or write about technology over a longer period of time, without having anything substantial to say grounded in material representations, Bazerman (1999) introduces the notion of *material accountability* (earlier discussed in more detail). In the constant flow of negotiation and renegotiation of meaning that constitute a discursive system, specific fixpoints are needed which can be kept constant - at least for a while - in order for actors to be able to converse in the belief that they percieve 'things' in the world in similar ways. As a way to understand these fixpoints, Bazerman (1999) introduces the notion of *discursive restingpoint* which acts and "becomes a basis for common understanding" (p. 346). Such a discursive restingpoint" can be viewed as a discursively constructed black-box which different parties can use without the need of continuously negotiate or re-negotiate the "meaning" of the artefact as such. It becomes a basis for a common understanding of the artefact.

In this research setting, we perceive the following specific discursive systems: *Economics* - which handles the way in which the platform owner communicates the different business opportunities that arises (let it be: new business models; pricing structures; added business values other than costs; other things that could affect the business in one way or the other). *Organization* - which handles the way the platform owner communicate how they organize and reorganize in order to be able to support the platform and its customer. *Orchestration of Ecosystem(s)* - which handles the way the platform owner communicates, and make possible, for different actors to join the ecosystem, but also how the platform owners themselves work on their position in relation to other actors.

Methodology

Inspired by Selander and colleagues (2013), we approached our object of inquiry as an artefact that has evolved over time. Accordingly, our research is designed as a historical case study (Kieser 1994). Since our aim was to follow the origins and evolution of the Microsoft Cloud Platform (Azure), we gathered data which spans over seven years - from the announcement of the *Community Technology Preview* of Windows Azure (2008-10-27) up until the 1st of January 2016. The upside with an historical approach is the large volume of (web-based) data available, which we couldn't get access to using primary data collecting methods solely (Rogers 2013; Romano et al. 2003). But at the same time, given the vastness of information there is, we acknowledge that a selection of material cannot be avoided (Kieser 1994).

Case Selection

Inspired by de Reuver et al. (2017), and their call for longitudinal studies on platform dynamics, we set out to investigate and follow the evolution of a digital platform. We find that cloud computing provided a particular interesting case, since some cloud computing services seem to evolve into platforms. Unlike many other types of digital platforms occurring in the literature, they operate partly according to other mechanisms when it comes to matchmaking, networks effects and business models. Furthermore, since these types of platforms often operate further down the "stack", they do not occur as often in general as well as academic debate as other platforms do. Yet another interesting aspect is that they can grow into relatively few actors (winner-takes-all mechanisms), but with much power. In a way, they have emerged as known-unknowns in discourse and our aim is to give them a bit more contour. As for choosing which type of cloud computing platform: We saw that there were three actors that would fit our research strategy - Amazon Web Services (AWS), Google Cloud and Microsoft Azure. We chose Microsoft Azure, and the reason is

threefold: (1) Google and Amazon already appears quite frequently as examples in platform literature, let alone they are not studied from a cloud computing perspective; (2) Microsoft has had a reputation for acting as a relatively closed software supplier, but over time - due to their development into a cloud service provider - they have come to adopt a more open approach; (3) As a former software product-centric supplier, Microsoft has made a pivotal strategic change in becoming a provider of cloud computing services.

Data Collection

To be able to articulate platformization process of Microsoft Azure over time we searched for an archive which would give us the possibility to get a rich dataset regarding both the material aspect and discursive work. We found the Official Microsoft Azure blog to be especially well-suited. Since the announcement of the Community Technology Preview of Windows Azure (2008-10-27), the blog has been the official communication platform for the overarching construct that Microsoft Azure is. Given the size of Microsoft as a company, and given the size of the technological construct that Microsoft Azure has become, a lot of specialized forums and blogs exists within Microsoft that handles the different technologies and artefacts to a much granular extent; nevertheless, the Azure blog brings the assembled news and information about what is happening on and to the platform - new software releases and updates (material aspect) that are shipped as well as information about conferences, courses, cost-structures, organization changes, acquisitions etcetera (aspects of discursive work).

Data Analysis

In analysing a blog over time, we shifted between two types of focus: On the one hand we analysed a given blog post on its own, while at the same time we tried to be receptive for eventual narratives rising through the flow of posts. In the process of finding a good approach to analysis, we had a great help from Klein and Meyers (1999) and their thoughts on 'parts' and 'whole': "that we come to understand a complex whole from preconceptions about the meanings of its parts and their relationships" (p. 71). In line with these thoughts, a need for a dual method approach became obvious. An approach where a deductive, thematic analysis would flesh out the platformization process at specific moments *in* time, complemented with an inductive, narrative approach which would give a vivid testament on how the process unfolded *over* time.

The deductive approach consisted of a thematic analysis where we approached the blog with our theoretical framework as a mean of organizing data. The two main categories digital materiality and discursive work, draws on draw on Putnam (2015; p. 706), and her claim that "the two phenomena are empirically distinct, but mutually implicated; that is, even though they may exist as an invisible whole". The themes used for coding, mirrored the categories lined out in the framework - digital materiality and discursive work - but since we noticed that the blog posts could consist of different types of materialities and/or discursive work we decided to be a bit more granular in order to capture, and give a picture of the information diversity. Therefore, by means of coding, digital materiality were divided into sub-themes of *generativity* and *convergence*. Through the text of the blog posts we derived *material accountability* (Bazerman 1999). As an example: "One of the exciting announcements we made last week at SXSW Interactive 2010 was the release of the Windows Azure Toolkit for Facebook [...]" (2010-03-24) [coded as *generativity*].

Year	Digital Materiality	Discursive_Work	Data points	Blog posts
2008	1		1	2
2009	11	7	18	14
2010	20	64	84	53
2011	59	126	185	116
2012	94	240	334	170
2013	47	179	226	126
2014	101	322	423	238
2015	160	406	566	292
Total	**493**	**1344**	**1837**	**1011**

Table 1. Outcome of thematic analysis

Discursive work was divided into sub-themes of *economics*, *organization*, *ecosystem*, and *training*. As an example: "Today, during the Microsoft Worldwide Partner Conference 2009 we announced the business and partner model for the Windows Azure platform [...]" (2009-07-14) [coded as *economics*]. A first round of coding aimed at reducing the data set (Romano et al. 2003). Since our period of interest stretched over the period 2008-10-27 to 2016-01-01, 2117 blog posts came to be the initial target for our inquiry. Every blog entry was inspected, an initial scan of the content was made in order to recon if it was applicable for the study (meaning that they were judged to fit into the framework of platformization). This round ended up with a workable corpus of 1011 entries. In the second round of coding, we used a more content analytical approach (Elo and Kyngäs 2008) where every blog entry was inspected, and where we

searched for which sub-theme(s) the blog entry could be said to represent. The sub-themes were in the end aggregated and presented as the initial categories. Therefore, the data points came to exceed the number of blog posts (table 1).

Given our intention of formulating 'platformization' as a process, we also needed a way to describe the *temporal* aspect. Here is where our inductive approach comes into play. Inspired by Pentlands (1999) view of narratives as "naturally suited to development of process theories and explanations" (p. 717), we perceived the blog as an overarching narrative of a 'cloud' (a 'whole'; cf. Klein and Myers 1999), with the different blog entries contributing, sometimes as fragmented and unique stories in their own rights, or as clusters, building webs of narratives which were spread over time - fabula's (Pentland 1999). During the first and second coding (described above), followed by another three, which focused entirely on the inductive aspect of the analysis, we could distinguish three sub-narratives important for the sense making of how the platform evolved over time.

Results: The Platformization of Microsoft Cloud Services

In October 2008 Microsoft announced their public cloud platform, then named Windows Azure, as a Community Technology Preview. In hindsight, this revelation appears as a relatively rudimentary platform - delivering a PaaS alternative for developing and deploying .NET applications, as well as storing data - but at the time, it emerged as an innovative construct aiming for developers to host their web applications. In February 2010 the GA (general availability) of Windows Azure was announced. The platform was primarily marketed as a way of reducing IT infrastructure costs due to the flexibility and agility latent within cloud computing technology. Over the years the platform has evolved from being quite uncomplicated to a complex construct, something our content analysis emphasizes when looking at the increasing posts on digital materiality (table 1). From a design perspective of today (2018), Microsoft Azure can be described as an ever-expanding platform which consists of a vast number (100+) of different cloud computing services, acting at different levels of the platform (IaaS, PaaS, SaaS). In what follows we describe the platformization process, going from the early stages back in 2008 to the beginning of 2016, through the unfolding of three different narratives: (1) A cost-effective cloud; (2) An innovative cloud; (3) A merging cloud.

Narrative 1: A cost-effective cloud

Although the commercial availability of the platform was announced in February 2010, the intention of how a business and partner model would look like was communicated already in July of 2009. "Today, during the Microsoft Worldwide Partner Conference 2009 we announced the business and partner model for the Windows Azure platform including service level agreements and support programs." (2009-07-14) Along with the SLA: s (service license agreement; covering service uptime, connectivity, and data availability) and support programs, a new pricing model were presented. The price model was to be consumption-based, introduce a kind of dynamic and elastic view on pricing, which would allow for customers to pay only for services and resources consumed. As a way for customers to be able to predict price, a subscription approach was to be employed. By demonstrating that companies were struggling with the paradoxical art to reduce costs from infrastructure investments, while at the same time try to increase value from investments already made, Azure was introduced as an attractive outsourcing alternative "that provides the flexibility and agility our customers need to tackle their business problems in new ways" (2010-02-01). Further, Azure was communicated as an appealing and cost-effective alternative for developing and deploying applications and services, but also as an entrance for firms to reach new markets and by that increase their revenue

During the early years of Azure only PaaS was offered, but in June 2012 it became more versatile by introducing IaaS as an additional layer: "We recently announced the release of Windows Azure Virtual Machines, an Infrastructure-as-a-Service (IaaS) offering in Windows Azure [...] [W]ith these infrastructure ingredients, the possibilities are so much more exciting [...] [W]e wanted to create a platform where customers and partners can deploy existing applications to take advantage of the reduced cost and ease of deployment offered in Windows Azure." (2012-06-25) The introduction of IaaS meant that Azure opened for Virtual Machines to run on the platform, and for customers to create fully managed computing resources in the cloud. This broadened the alternative for outsourcing capabilities to also include pure infrastructure components (computers and servers).

Over the years, a competition in the cloud computing market has arisen and Amazon, through its cloud service platform AWS, has established itself as the actor which everyone else has come to compare themselves against. To become and stay relevant, a competition on price was inevitable: "Today we are also announcing a commitment to match Amazon Web Services prices for commodity services such as compute, storage and bandwidth. This starts with reducing our GA prices on Virtual Machines and Cloud Services by 21-33%." (2013-04-16) Apart from good performance, and quality of services delivered, price appeared as the primary aspect of competition in the cloud service arena.

The recognition of economics as a primary driver for adopting cloud services was strengthened when even greater price adjustments were implemented, also this time related to AWS. "Consistent with our previously announced commitment to match Amazon on prices for commodity services, we are cutting prices on compute by up to 35% and storage by up to 65%. We recognize that economics is a primary driver for some customers adopting cloud and stand by our commitment to match prices and be best-in-class on price performance." (2014-03-31)

The journey to adopt cloud services in a correct manner was becoming more complicated, and in an effort to help the notion of a "cloud handshake" was introduced: "It's through mastery of the elements above our standard cloud services that you can achieve the workload-specific assurances you are seeking. The cloud handshake is the proper marriage of understanding the services we provide and building and configuring your workloads properly atop them." (2015-06-15) The handshake referred to the need of partly understand the native services deployed by the Azure platform, but also how to utilize them in a correct manner in relation to the configuration possibilities given with respect to distributing workloads, storage, and app services across Azure regions. According to a customer survey performed by Microsoft in August 2015, most of the respondents (CIOs) brought forward a belief that cloud computing was an alternative for outsourcing and hosting. Building on the notion of "cloud handshake" and the importance of implementing and understanding Azure correctly, a maturity model of "Cloud Economics" (2015-08-13) was introduced. The model indicated that using the cloud wrongly would in fact lead to raised costs. "Like with many maturity models, your organization must gain experience in the first stage to understand and start reaping the gains from the latter two which are where savings turn into profits. You can't afford to pass up the opportunity cloud computing presents for turning IT from cost centre into revenue driver" (2015-08-13). The discourse of 'business-value' was yet again expanded to now, apart from being a 'cost-effective' alternative and a driver for 'innovation', also include a notion of 'evolution' from the former to the latter.

Narrative 2: An innovative cloud

To the 'business-value' discourse - which up until now has been concentrated on price models and cost reduction - a view on innovation as an equally important aspect of employing cloud services were added. In the search to appear as an innovative alternative, Microsoft Azure started to adopt different ways to hook into other types of platforms. "One of the exciting announcements we made last week at SXSW Interactive 2010 was the release of the Windows Azure Toolkit for Facebook. This new toolkit [...] enables developers to rapidly develop Facebook applications on Windows Azure." (2010-03-24) By opening up for develop applications on other platforms, Azure tried to stimulate and invite developers from other ecosystems to develop and use the platform. Apart from delivering SDK: s and framework for developers to use, another aspect where Azure opened for innovation to happen was the appearance of the Windows Azure Marketplace. The marketplace was designed as a gathering place which "includes listings of building block components, training, services, and finished services/applications. These building blocks are designed to be incorporated by other developers into their Windows Azure platform applications." (2010-12-07). Azure Marketplace was communicated as a way towards simplifying the process of developing and building applications on Azure. The marketplace was introduced as a repository which contained resources that could be used to compose applications and services in a modular fashion.

In line with the vision of becoming a supplier which acted on many platforms, the focus of innovation came not only to include traditional Microsoft targets such as desktops and laptops, but to also include mobile devices. The intention was to give developers the possibility to build "native experiences on multiple platforms using Windows Azure" (2011-05-09). Along with the toolkit for Windows Phone 7, which was released in March 2010, the next step was to release an iOS version of the toolkit. "This toolkit contains resources and services designed to make it easier for iOS developers to use Windows Azure" (2011-05-09). In the end of 2011, the Toolkit for Android was released (2011-08-31).

In the early years of the platform, only PaaS was offered, but through the introduction of IaaS and the possibility to run virtual machines on Azure, vast new opportunities arose. One of them included the possibility of running Linux on Azure: "Our goal in building support for Linux is to provide a first-class experience to our customers. […] [T]his is a journey that has just begun for us. With this release you can see the early results of our work in this area." (2012-06-14) This opened for the Linux family and its surrounding ecosystem to be harboured on the Azure platform.

Not only products and services drive user bases, but also artefacts such as programming languages and in order to engage more developer, Microsoft Azure introduced yet another language: "[T]he release of Python Tools for Visual Studio and Python on Windows Azure. This powerful paradigm means instant access to the vast and deep Python ecosystem in a highly productive environment, backed by solid availability and scalability of Windows Azure." (2012-07-02) The platform emerged more and more as a habitat for different flavours of digital technologies to operate upon (different operating systems), as well as operated through (programming languages, SDK: s and frameworks). On the one hand, Azure was building and nurturing ecosystems around its own axis, but another strategy which grew stronger over time, was to tap into already existing ecosystems as well. "As part of our continuing commitment to open source, we are happy to announce today that the Mobile Services SDK will be available on GitHub, and as always we are welcoming community contributions" (2012-09-20). Through the commitment to open source, Azure - on the one hand - got access to a vast number of developers which circulated on the GitHub platform, while on the other could also benefit from a reputation gain which eventually comes when committing to these kinds of endeavours. On the further work of being an actor in the open source arena, MS Open Tech - which was a wholly owned subsidiary - strived to bridge Microsoft technologies and open source technologies. "Over the last several months, MS Open Tech has partnered with Windows Azure Mobile Services to enable developers utilizing open source technologies deliver new cloud-based experiences in mobile and web apps across devices." (2013-07-15). Building further on the 'openness' discourse, MS Open Tech announced new partnerships with OpenNebula and Packer.io (2014-07-21) and concluded that "these projects build on our commitment to supporting customers' needs and desire for choice, allowing them to quickly build, deploy and manage applications by offering the broadest set of operating systems, languages, and services of any public cloud—from Windows, SQL and .NET to Python, Ruby, Node.js, Java, Hadoop, Linux, and Oracle" (2014-07-21). Again, Microsoft Azure was communicated as an open and innovative construct on many levels, let it be from the perspective of a developer, IT-professional or an ordinary user.

The notion of IoT started to get a foothold on the platform in mid-2015, and "the Azure IoT Suite brings together preconfigured offerings to enable companies to quickly and easily develop and deploy Internet of Things solutions" (2015-09-29) Through sensors and the rise of artificial intelligence through Cognitive Services, a discourse of an "intelligent cloud, intelligent edge" started to emerge on the platform.

Narrative 3: Cloud as platform

On the work on being perceived as one encompassing unity, Azure started to use itself as a platform for others to build upon. Through that approach the platform diffused as infrastructure to build on. "One of the exciting announcements we made last week at SXSW Interactive 2010 was the release of the Windows Azure Toolkit for Facebook" (2010-03-24). On the one hand, the release pointed towards an innovative perspective (see above: *An innovative cloud*), but at the same time, by using Azure as an infrastructure the platform became a sediment.

Through the acknowledgment of customers ongoing struggle to embrace the cloud fully - and instead recognized customers need of connect to data across a mix of datacentres - the notion of a "hybrid cloud" was introduced. The hybrid cloud was a "solution that provides the necessary flexibility for the different ways you will architect, develop and deploy your applications and IT solutions– be it on-premises, in the cloud, or a mix of both." (2012-06-06). The notion of "Hybrid" referred to the fact that some of the customers' applications and/or data could not be moved to the cloud but needed to remain in the customer's owned datacentre. The compromise between cloud and private became hybrid.

Compared to the traditional view of Microsoft being the focal actor in its own ecosystem, it was now communicated that to be able to run a successful cloud computing platform, the need for developing and acting within wider ecosystems was vital for survival: "[N]ow, we're focused on the enterprise cloud. That's why you've seen us work with Amazon to bring […] the entire Microsoft stack to Amazon Web Services. The need for technologies to work together is particularly clear in cloud computing – where platforms and

services are so incredibly connected." (2013-06-20) In this sentence, the paradoxical nature of digital artefacts emerged as a platform acting both as a platform to build on and an infrastructure to use. Also, that a single cloud provider could not work solely on their own; the need of cooperation at some levels was a prerequisite for survival.

But, there not only existed a needed for cooperation between cloud providers, additionally a need for integrating Microsoft's own services in order to give the feel of one unity – a 'cloud'. One of the key factors when enabling transparent, lateral movement between systems appeared to be to solve the identity question. How to avoid users being forced to have multiple user id's and passwords, and instead have just one? Enhancements in the identity management tool *Windows Azure Active Directory* was communicated to "enable integration of identities across both Microsoft and third-party SaaS applications, making it super easy for users to get their work done without having to remember individual user ids and passwords for each online app."

By communicating a vision of a 'mobile-first, cloud-first' world (2014-04-08), Microsoft was trying to help customers embrace the technology of cloud-computing. One attempt which was communicated as a way for make it easier for customers to adopt, was to form strategic partnerships with communication companies which could, through easier connectivity, help in getting the technology to the customers. Through the invention of the ExpressRoute service, and through alliances with telecommunication companies, the ExpressRoute ecosystem was expanding. These initiatives not only brought additional choices in cloud solutions (i.e. Hybrid-cloud), but also these choices of connection types through ExpressRoute "also provide a more secure and reliable connectivity option for enterprise customers, reducing barriers for adoption of cloud computing and accelerating the growth of Microsoft Azure" (2014-04-08) ExpressRoute thereby acted as a bridge. Through a dedicated, private connection from a firm's on-premise datacentre, to the public cloud, the border between the 'cloud' and the 'local' became blurred, hence 'hybrid'.

Although the introduction of Virtual Machines on Azure - and by that offering IaaS - meant a big leap of innovation capabilities, it was communicated that the working process around the deployment of said Virtual Machines could be standardized and integrated by means of automation. The possibility of automating tasks around the creation and deployment of Virtual Machine triggered the development of "template-based deployments". The goals with this release were quite simple: "[T]o transform building, deploying and managing large-scale complex applications into simple actions. This new template language will enable you to easily stitch together VMs, Virtual Networks, Storage Accounts, NICs, Load-balancers, and other PaaS services, like App Service and SQL Databases, in a single coherent application model." (2015-04-29) Through the implementation of this converging technology, the possibility to prepare and deploy VMs in an automated way gave the possibility to standardize and implement consistent working processes. Also, this more flexible and simplified model to launch and manage Virtual Machines enabled a new wave of partners to make use of Azure.

In order to meet forthcoming customer need, Microsoft communicated the need to invest in an infrastructure which could deliver cloud services that would match up to future wants of interaction with technology; a need of planning and stay-ahead regarding the expansion became obvious and Microsoft presented a strategy on subsea and terrestrial dark fiber capacity. That they had been significantly investing in their capacity - through engagements in partnerships - which spanned oceans and continents. "[T]oday our connections across the Atlantic and Pacific just got stronger. We announced deals [...] in which Microsoft is investing in a cable with each company to connect Microsoft's datacentre infrastructure from North America to Ireland and on to the United Kingdom. These cables will help deliver data at higher speeds, with higher capacity and lower latency for our customers across the globe." (2015-05-11) Through these investments Azure was thought to be able to tackle coming issues of bandwidth and latency and give customers an even greater possibility to scale their businesses around the globe as well as possibilities to diffuse data over several locations.

Discussion

In applying the lens of platformization on the official Azure blog, we found a way to sort out the digital artefacts constituting the platform and the discursive work needed to try to make sense of it. As we noted in the results section, Microsoft has through material undertakings and the belonging discursive work expanded the platform both as a digital construct as well as a concept in the minds of people. Accordingly,

the Microsoft Azure emerges as a product of the entanglement between digital materiality and discursive work.

The materiality of platformization

Platformization has been put forward as a notion that points to the platform rising as a dominant infrastructural and economic model for social media platforms (Helmond 2015; Nieborg and Poell 2018). What became obvious in narrative 3, was that Microsoft – in order to be able to construct a common infrastructure – continuously worked with different strategies to converge their different technologies. Here we conclude that the process of convergence is closely linked to the notion of infrastructure. The perception of an infrastructure is often located to a specific layer of the network stack, let it be at the lower levels with focus on routers, cables, and switches; or at the higher levels with focus on protocols, databases and applications. But as the results showed, Microsoft Azure operates and consolidates at every level of the stack. E.g. they are working with subsea cables to develop their fiber capacity; they work with their service ExpressRoute to give customers a better connectivity between on-premises resources and the public cloud; they work with single-sign-on solutions freeing customers from having to have multiple user-id's and passwords. On the one hand, Microsoft enable other platform developers to operate on their platform when announcing the possibility to develop Facebook applications on the Microsoft Azure platform (2010-03-24); in this scenario Azure is 'infrastructuralizing' (Plantin et al. 2018) and becomes a fundament for Facebook application developers. On the other hand, they bring the possibility to run Microsoft services on other platforms as we saw when they brought their whole stack to Amazon (AWS) (2013-06-20), and by that opening up for Amazon customers to use Azure infrastructure services.

Hereby, we perceive the *convergent* aspect of the cloud platform as the process where the main goal is to converge and integrate disparate technologies into distributed yet interoperable parts (Kallinikos et al. 2013; Tilson et al. 2010). The intention is to give a feeling of 'oneness', a 'cloud', and thereby for technologies to become transparent to use (Star and Ruhleder 1996). This work does also include the invention of standards and standardization (Hanseth 2000; Hanseth and Lyytinen 2010). But not only is this oneness to be dealt with at an architectural level, it is also a question of interaction and responsiveness; although systems are interconnected, they can feel as parts if the response times and ease of use is not at a sufficient level. Therefore, we also include limiting factors such as *latency* and *bandwidth* in this category (Zhang et al. 2010); meaning that initiatives taken to reduce latency and/or deal with bandwidth issues will fall into this category as well. All in all, the convergent aspect is about, on the one hand making the platforms different parts interoperable, and on the other diffuse it into the wider part of internet (Helmond 2015).

Apart from the infrastructural aspect of platformization, we argue that the concept also must embrace the *generative* dimension of the platform. In narrative 1 and 2, it became clear that Microsoft, over time, has increased their intensity and focus on working with and highlighting the innovative capacity of the platform. From traditionally have being perceived as a cost-effective outsourcing alternative to now being described as an ever-evolving innovative platform, Microsoft Azure undoubtedly bears a characteristic of being *generative*. New services are deployed at even intervals, and old ones are continuously being updated. Following the description of digital artefacts as being intentionally unfinished (Kallinikos et al. 2013) the feeling of a design process which is not fully closed comes to mind. If we let this argument act as a foundation for how to perceive Microsoft Azure, the services deployed can be viewed as semi-finished, general-purpose technologies. Semi-finished in the sense that they are intentionally unfinished digital artefacts. General purpose in the sense that the technology delivered has no initial direction and is of a multipurpose character. A characteristic which implies that the technology can be used in many different areas for various purposes, with the limitation of use related more to the customers own imagination and experience than to the capacity of the technology itself.

Given Zittrains (2005) definition of *generativity* as "a technology's overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiencies" (p. 1980), the Cloud Computing Platform appear as a highly generative construct. The Cloud Computing Platform can act as a full-blown infrastructure alternative (IaaS) and this layer could probably be considered the most generative of the three, in relation to the aspects of digitality (Yoo et al. 2010; Yoo et al. 2012; Kallinikos et al. 2010; Kallinikos et al. 2013). At the PaaS level, developers do not need to bother about the underlying hardware and software layers, instead they use the platform as a facilitator of development and deployment of application (Marston

et al. 2011). At the SaaS level, the cloud provider presents complete, on-demand applications and services (API:s) ready to run from the platform over the Internet (Zhang et al. 2010).

The above discussion points to that the Cloud Platform has the somewhat ambiguous capacity to act as both an infrastructure, as well as a platform. These findings align with Plantins et al. (2018) and their 'theoretical bifocal' perspective on infrastructures and platforms. As a comparison we turn to Tilson et al. (2010) and their view on infrastructures and platforms: They describe a platform as a semi-closed, highly complex suite of IT-capabilities with an initial specification and controlled design context; while the infrastructure is presented as a recursively composed artefact which consists of other infrastructures, platforms and IT-capabilities. A reasoning that implies that the innovative capabilities of today becomes the infrastructural instruments of tomorrow (Star and Bowker 2006). With regards to these definitions and thoughts, Microsoft Azure emerges both as a platform as well as an infrastructure.

The discursive work of platformization

Digital materiality gains meaning through discourse. How to approach, use, program, speak about, and present all the different digital technologies presented on Microsoft Azure depends on how narratives of said technologies are framed within present, recognizable social and technological meanings. Technology is mute, and it is only through discursive work it takes on representations which brings meaning and force to its appearance in different discursive systems (Bazerman 1999; Gillespie 2010). Although the blog's primary audience can be considered technically interested and knowledgeable, and its primary purpose therefore is to explain the technology and its capabilities, we have noticed that the blog's authors have had to make sense of the cloud platform and its possibilities in various other discursive systems as well. This goes in line with Bazerman (1998, p. 384) statement: "The words of technology [...] seem to flow all over the discursive landscape, arguing for value in the terms of business, law, government, the public and consumers". As the three narratives bears testament of, it became clear that Microsoft continuously was working to discursively frame their services and technologies in relation to the context of economics, technology, culture, and orchestration of ecosystems.

Over time, and as the platform grew more and more complex, it became apparent that the discursive work needed to increase to assure that the construct stayed intelligible and relevant (see table 1). In the result section we could see proof of different kind of discursive work, all from explaining and giving examples on how to use specific technologies, to how different business models and pricing-models were communicated. In this continuous work of symbolic integration, there is a need to solidify discourse – in a way anchor the new technologies to familiar concepts and by that gain new understanding. Bazerman's (1999) notion of 'discursive restingpoint' points to the need of stable representations within discourse. These resting points serves a kind of consensually agreed upon, and good-enough semantically shared, concept. In analyzing the blog, it became evident that Microsoft continuously is in need of inventing such resting points in order to get an intelligible and comprehensible discourse describing and making sense of the platform. As two example we present the notions of "cloud handshake" and "cloud economics".

The notion of the *"cloud handshake"* appeared as a discursive abstraction for the need for customers to on the one hand, understand the services level agreements provided by Microsoft Azure, and on the other hand, how their own applications running on top of the platform were being managed. What Microsoft signaled here is the dual responsibility of success, that the public cloud provider presents general purpose technology, which is managed up to a certain degree, but the customer also has a part in the equation by deploying and manage the specific configurations of the application. The metaphor of a handshake gives the picture of two parties agreeing on the underlying terms. In the notion of a "cloud handshake" Microsoft tries to establish 'discursive resting point' (Bazerman 1999), which encompasses the meanings of how and to whom accountability is appointed when it comes to deploying, managing and running applications on Azure.

"Cloud economics" appeared as a discursive solution to the perceiving of the cloud as an evolution of the outsourcing perspective which could drive down expenses from capital and operations. Furthermore, although the business models of the cloud computing platform appeared as rather simplistic - subscription-based, "as a service" - the underlying complexity of the artefact as such, might lead customers to use the platform in a not feasible way, which could end up in opposite results. Therefore, a more nuanced picture on how to look on revenue, profit and margins from a cloud perspective, needed to be communicated. The notion of "cloud economics" pointed to the fact that the financial aspects of Information Technology would

need to be viewed from quite a different angle, when it came to act and driving successful businesses with the use of cloud computing platforms.

Towards a model of platformization

Helmonds (2015) notion of platformization is geared against social media platforms, and the conclusion she therefore draws on how the process unfolds is not quite compatible compared to a cloud computing platform. Helmond points to a dual logic, where social media platforms extend and decentralize as an infrastructural model into the rest of the web but uses these extensions to centralize and make the external data ready for its own platform to use (p. 8). While this tactic for platform growth could be seen as an outstretched, almost invasive, approach, it plays out quite differently for the cloud computing platform. This has most certainly to do with the different business models applied. Since social media platforms almost solely relies on advertising, their need for collecting data is inexhaustible (Srnicek 2017). The cloud computing platform, on the other hand, relies on its service-driven, subscription-like business model. Instead of trying to infiltrate into existing data structures running on remote resources, these types of platforms aim to replace remote resources completely. Instead of feeding off the Internet, these platforms *feed on* the Internet. They are not aiming to be relevant in just one ecosystem, but many and at the same time. The big cloud computing platforms therefore uses a more circumventing tactic, trying to entrap customers in every aspect of their digital lives – let it be mail, collaboration applications, streaming services, web applications, virtual machines etcetera. Their end goal is to become the primary alternative for digital innovation and infrastructural undertakings - operating at every layer of the stack as they do - where all computing activity performed by customers is to be executed on their platform.

In order to make sense of these types of platforms we argue that we need to approach them with the bifocal perspective of platforms and infrastructures (Plantin et al. 2018). They have a strong, convergent characteristic in their constant ongoing work to short-circuit digital spaces and thus enable themselves to become credible and reliable content providers as well as a preferred infrastructure delivery. At the same time, they possess an increasing generative potential through a constant flow of new, intentionally unfinished, IT-capabilities. During the evolution of the platform, both these aspects are at play and is needed for the platform to stay relevant as an innovative yet stable artefact.

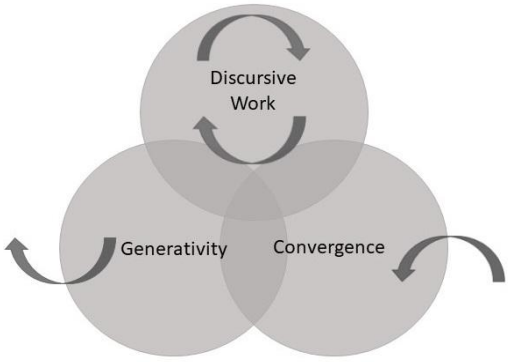

Figure 2. A process perspective of Platformizaion

Rooted in on our findings and further discussion we propose a process perspective which characterize the nature of platformization for cloud computing platforms based on the notions of generativity, convergence and discursive work (see figure 2). We perceive *generativity* as an outward movement which aims to continuously bring new and innovative capabilities to the platform; over time – and as the cost-effective aspect has become increasingly self-evident and mainstream – the generative aspect of the platform appears as the competitive edge. *Convergence* is perceived as an inward movement and points to the dual work of, on the one hand, bringing together all disparate services and products that works under the umbrella of a cloud platform, to give the customer a feeling of 'oneness'; and on the other hand – through the work of integration, interoperability, and standardization - align the wider infrastructure to extend the reach and scope of the platform. The *discursive work* appears as a circular, ongoing activity aimed at making sense of the ever-evolving construct. One fundamental theoretical underpinning of this model is that, although the

discursive work aims to establish and give meaning to the artefact, there can be nothing without material accountability (Bazerman 1999).

Conclusion

The digital platform has in a few years emerged as a key concept to depict a new kind of business model, organizational form and technical architecture. We inquired into the evolution of one such digital platform, in order to understand the nature of this platformization. We showed how *Microsoft Azure*, has evolved from being mainly an efficient cloud service to become an innovative cloud platform. By presenting three narratives we showed how the platformizations process was shaped by both the evolving digital materiality of the artefacts, and the discursive work conducted by Microsoft through their official Microsoft Azure blog. Our contribution is threefold: First we add to the knowledge of innovative cloud platforms more specifically, and platform dynamics and platformization processes more generally. Second, we contribute by emphasizing generativity as a vital component in the platformization process of a cloud platform. Thirdly, we point to the importance of discursive work on a cloud platform, as it tends to grow organically, with new services that are constantly being introduced and therefore need to be made understandable and clarified.

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